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LUNG CANCER AND PASSIVE SMOKING

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Fifty-one women with lung cancer and 163 other hospital patients were interviewed regarding the smoking habits of themselves and their husbands. Forty of the lung cancer cases and 149 of the other patients were non-smokers. Among the non-smoking women there was a statistically significant difference between the cancer cases and the other patients with respect to their husbands' smoking habits. Estimates of the relative risk of lung cancer associated with having a husband who smokes were 2.4 for a smoker of less than one pack and 3.4 for women whose husbands smoked more than one pack of cigarettes per day. The limitations of the data are examined; it is evident that further investigation of this issue is warranted.

Acute and chronic effects on lung function and the cardiovascular system have been noted in non-smokers involuntarily or passively exposed to the cigarette smoke of others (Aronow, 1978; Lenfant and Liu, 1980). We report observations suggesting that the effects of such exposure may include the most notorious health consequence of smoking among smokers themselves - carcinoma of the lung.

MATERIAL AND METHODS

This is a case-control study. The cases were all of the female, Caucasian patients, registered as residents of Athens, who were admitted to any of three large hospitals in Athens, between September 1978 and June 1980, with a final diagnosis of lung cancer other than adenocarcinoma or terminal bronchial (alveolar) carcinoma. The hospitals were the largest chest hospital of Athens ("Sotiria"), the largest cancer hospital ("Agios Savas") and the only other hospital exclusively for cancer patients ("Agii Anargyri"). Of the 51 cases identified, 14 were histologically and 19 cytologically confirmed, while in 18 the diagnosis was based on clinical and radiological evidence. Diagnosis of adenocarcinoma can confidently be excluded in the 14 histologically confirmed cases. It is possible that some adenocarcinomas are included among the 19 cytologically diagnosed cases and probable that there are some among the 18 clinically diagnosed patients. However, even in unselected clinical series of lung cancer cases among women in Greece, adenocarcinomas and alveolar carcinomas do not represent more than one-third of cases (Papacharalampous, personal communication): the number in our series is therefore not likely to be more than seven or eight.

Comparison patients (controls) were hospitalized during the same time period in the Athens Hospital for Orthopedic Disorders (KAT). This hospital is located in the same area of Athens as those which were the sources of the cases. The hospitals from which the cases came were considered unsuitable as sources of controls because of the high proportion of patients with other diseases of the lungs and other smoking-related diseases: we did not wish to have the interviewer judge, on a case-by-case basis, the suitability of a patient for control purposes. Six times during the time-period of the study, the same physician who interviewed the cases visited the Hospital for Orthopedic Disorders and interviewed all the available adult women patients in two departments of the hospital. Non-Caucasian patients and patients not registered as residents of Athens were not included. Of the 163 controls so ascertained, 108 were being treated for fractures, 18 for osteoarthrosis and 37 for other bone and joint diseases.

All cases and comparison patients (controls) were interviewed by the same physician. They were asked about the smoking habits of themselves and their husbands. Specifically, they were asked when they started smoking, if and when they stopped and what was the average number of cigarettes smoked daily; the same questions were asked about their husbands. Those who had stopped smoking 5-20 years before the interview were classified as ex-smokers; those who had stopped smoking within 5 years of the interview were considered as current smokers; and those who stopped smoking more than 20 years previously were classified as non-smokers. For the computation of the total number of cigarettes smoked by her husband, a woman's exposure was considered to start with her marriage and to end when she was divorced, or when the husband died or stopped smoking. A change of husband was considered as a change in the husband's smoking habits (if the two were in fact different), and singleness was considered the equivalent of marriage to a non-smoker.

Statistical significance is assessed by the X^2 for linear trend in proportions, as described by Armitage (1971).

RESULTS

Demographic characteristics of the cases and controls are compared in Table I. The groups are similar in age, as indicated by the distributions in Table I and means of 61.7 for cases and 62.1 for controls. Duration of marriage, occupation, socioeconomic status (as measured by years of schooling) and recent residence are not notably or significantly different between cases and controls. It is, therefore, not necessary to stratify for these variables in the analysis particularly since none is significantly associated

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TABLE I

DEMOGRAPHIC CHARACTERISTICS OF THE CASE AND CONTROL PATIENTS

Characteristic	Number		Percentage	
	Cases	Controls	Cases	Controls
Total number	51	163	100.0	100.0
Age:				
<50 years	7	21	13.7	12.9
50–69 years	30	98	58.8	60.1
70+ years	14	44	27.5	27.0
Never married	1	15	2.0	9.2
Duration of marriage[1]:				
<20 years	8	33	16.0	22.3
20–39 years	31	70	62.0	47.3
40 years	11	45	22.0	30.4
Occupation:				
Housewife	32	96	62.7	58.9
Agriculture or labor	12	44	23.5	27.0
Schooling of 6+ years	19	71	37.3	43.6
Recent residence[2]:				
Urban	34	101	66.7	62.0
Semi-urban	3	13	5.9	8.0
Rural	14	49	27.5	30.1

[1] Percentages of the married – [2] All patients were registered as resident in Athens, but some had changed residence recently, perhaps in connection with their need for medical care. Classified according to standard classification of the Greek National Statistical Service.

with smoking in these data. The duration of schooling of the husband was slightly longer in controls than in cases (65.0% 6 years or more, compared to 54.9%) but again was not related to smoking habit.

Among the 51 women with lung cancer, 11 were smokers, whereas among the 163 control women 14 were smokers, giving a relative risk associated with smoking of 2.9. These 25 women were excluded from the following analysis. The mean age of the remaining 40 lung cancer patients was 62.8 years and of the 149 remaining control women 62.3 years. Among non-smokers, control women were of only slightly higher socioeconomic status than the cancer patients - 63% of their husbands had finished primary school, compared to 58% among the controls.

Table II shows the distribution of non-smoking women with lung cancer and of non-smoking control women according to current smoking habits of their husbands. There is a statistically significant association between the husband's smoking and a woman's lung cancer risk. A non-smoking woman whose husband is a regular smoker has a risk of developing lung cancer which is twice as high as that of a non-smoking woman married to a non-smoker.

Table III shows the distribution of non-smoking women with lung cancer and of non-smoking control women according to the estimated total number of cigarettes smoked by their husbands by the time of the interview. It may be noted that there are only 64 women in the "zero" category since the husbands of three women with lung cancer and of 15 controls died, or divorced their wives, or stopped smoking, more than 20 years ago and thus were classified among the non-smokers in Table II. There is a statistically significant association between total number of cigarettes smoked by the husband and a woman's lung cancer risk. The association between husband's smoking habits and wife's lung cancer risk was examined separately for patients with or without cytological confirmation of the cancer. The slope of the linear trend was practically identical in the two groups.

TABLE II

SMOKING HABITS OF HUSBANDS OF NON-SMOKING WOMEN WITH LUNG CANCER AND OF NON-SMOKING CONTROL WOMEN

Diagnostic group	Non-smokers	Ex-smokers	Cigarettes per day (current smokers)				
			1–10	11–20	21–30	31+	Total
Lung cancer	11	6	2	13	4	4	40
Controls	71	22	9	32	6	9	149
RR[1]	1.0	1.8	2.4		3.4		

[1] Relative risk – the ratio of the risk of lung cancer among women whose husbands belong to a particular smoking category to that among women whose husbands are non-smokers. – X^2 (linear trend) = 6.45, p (2-tail) <0.02.

It was noted above that the proportion of never-married women is lower among the cases than among the controls, and, since single women have been classified with those whose husbands were non-smokers, the associations in Tables II and III are stronger than would have been observed if concern were limited to ever-married women. In Athens, in the age-groups involved in this study, never-married women tend to have the traditional values and habits associated with singleness in elderly women and for this reason are, we believe, correctly classified in the extreme group of women never having been exposed to a husband's cigarette smoking. However, if the single women are excluded, the association remains significant ($X^2 = 4.6$; $p=0.03$) and relative risks of 1.5, 2.0 and 3.0 are observed for the three categories of husband's smoking for which relative risks are shown in Table II.

unusual opportunity to investigate this issue. Until about 20 years ago, smoking was unusual among women, whereas it was already quite common among men (Greek Cancer Society, 1978). It is therefore easier to discover an effect of passive smoking among Greek women than among men or women in other Western populations, since in the latter groups the overwhelming effects of active smoking, together with the high correlation between smoking habits of spouses, will confound and conceal the lesser effects of passive smoking.

It is, on first consideration, strange that the relative risk associated with passive smoking in this study (2.4 for all categories of smokers combined) is only slightly lower than the figure of 2.9 associated with active smoking by the women themselves. However, the numbers are small and the confidence

TABLE III

DISTRIBUTION OF NON-SMOKING WOMEN WITH LUNG CANCER AND OF NON-SMOKING CONTROL WOMEN ACCORDING TO THE ESTIMATED TOTAL NUMBER OF CIGARETTES SMOKED BY THEIR HUSBANDS BY THE TIME OF THE INTERVIEW

Diagnostic group	Total number of cigarettes (in thousands)						
	0	1-99	100-199	200-299	300-399	400+	Total
Lung cancer	8	4	6	9	6	7	40
Controls	56	21	26	16	12	18	149
RR[1]	1.0	1.3	2.5		3.0		

[1] See footnote to Table I. X^2 (linear trend) = 6.50, p (2-tail) <0.02.

DISCUSSION

This study has obvious limitations and is offered principally to suggest that further investigation of this issue should be pressed. Most seriously, the numbers of cases are small. Nevertheless, the association is in the direction expected - if any association were to be expected - and is unlikely to be due to chance. There is a high percentage (35%) of cases lacking cytology, but the association existed both in those with and in those without cytologic diagnosis. That the comparison group was taken from a different hospital from those of the cases may also raise questions. However, the ratio of smokers among the cases themselves to that among the comparison patients is about as expected from previous studies of smoking and lung cancer in women (Hammond, 1966; Doll *et al.*, 1980), and no major demographic difference between cases and controls was found, other than in the proportion of single women. The difference in the proportion of single women is consistent with the hypothesis of a meaningful association between lung cancer risk and husband's smoking, but in any event cannot explain the difference observed within the group of married women.

Against the limitations of the study must be put the fact that the Greek setting provides a somewhat unusual opportunity to investigate this issue. Until about 20 years ago, smoking was unusual among women, whereas it was already quite common among men (Greek Cancer Society, 1978). It is therefore easier to discover an effect of passive smoking among Greek women than among men or women in other Western populations, since in the latter groups the overwhelming effects of active smoking, together with the high correlation between smoking habits of spouses, will confound and conceal the lesser effects of passive smoking.

It is, on first consideration, strange that the relative risk associated with passive smoking in this study (2.4 for all categories of smokers combined) is only slightly lower than the figure of 2.9 associated with active smoking by the women themselves. However, the numbers are small and the confidence limits of the latter figure are broad (95%, 1.3-6.8). In the only other controlled study of this matter in Greece (Kanellakis *et al.*, 1976), smokers of less than one pack of cigarettes a day had a 5-fold and smokers of more than one pack per day a 20-fold increase in lung cancer relative to non-smokers. These are the risks appropriately compared with our estimates of 2.4 and 3.4 associated with husband's smoking of similar amounts. Further, active "smoking" does not have the same connotation in men and women. Women smokers tend to smoke less heavily than male smokers but have lower relative risks of lung cancer even for a given level of smoking (Hammond, 1972). The explanation appears to lie in the facts that duration of smoking is an important determinant of risk, women in the current lung cancer ages commenced smoking at a later age than men of similar age and have therefore been smoking for shorter periods, and substantially smaller proportions of women than men inhale (Wald, 1978; Doll *et al.*, 1980). These factors complicate a comparison of the risks associated with active and passive smoking, but at least one of them - the frequency of inhalation - seems likely to operate in favor of a relatively larger effect for passive than for active smoking, other components of the exposure being equal. Finally, it has been observed that smokers tend to clus-

ter together socially (Reeder, 1977), and the smoking habits of a woman's husband may be an index of a broader exposure to cigarette smoke than that which emanates from the husband himself.

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